SOIL SURVEY OF

Norton County, Kansas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Kansas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1961-72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Norton County Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and [redacted] using the General Soil Map and the information in the text. Translucent material can be used [redacted]

Contents

Summary of Tables

SOIL SURVEY OF NORTON COUNTY, KANSAS

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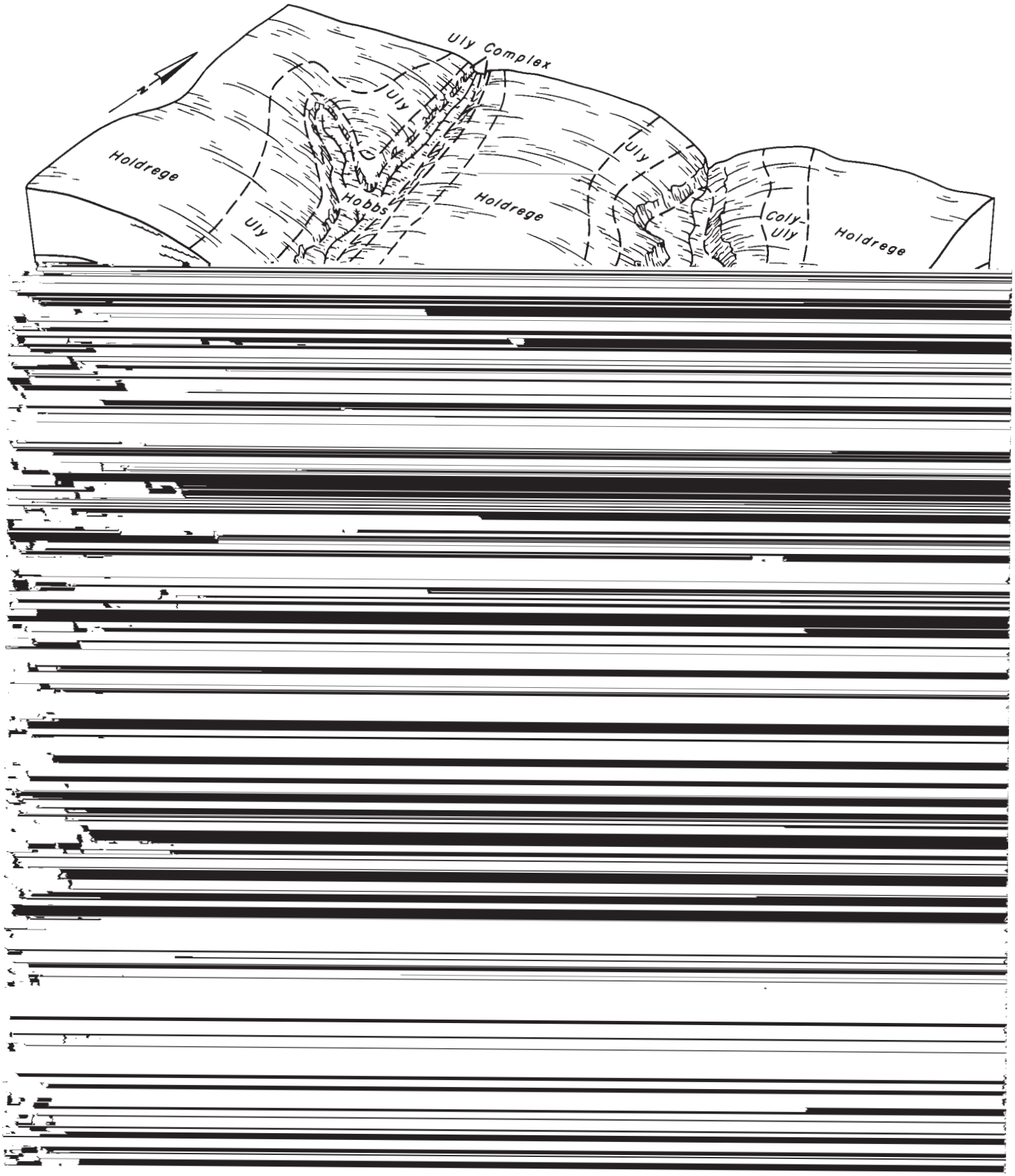
UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE KANSAS AGRICULTURAL EXPERIMENT STATION

NORTON COUNTY, in the northwestern part of Kansas, covers a total area of 880 square miles, or 558,080 acres. Norton, near the center of the county, is the county seat. The population of the county in 1972 was about 7,652 (6). Farming is the most important

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Norton County, where they are located,

[redacted]


N
Uly Complex
Uly
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Holdrege
Hobbs
Holdrege
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Coly-
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Holdrege

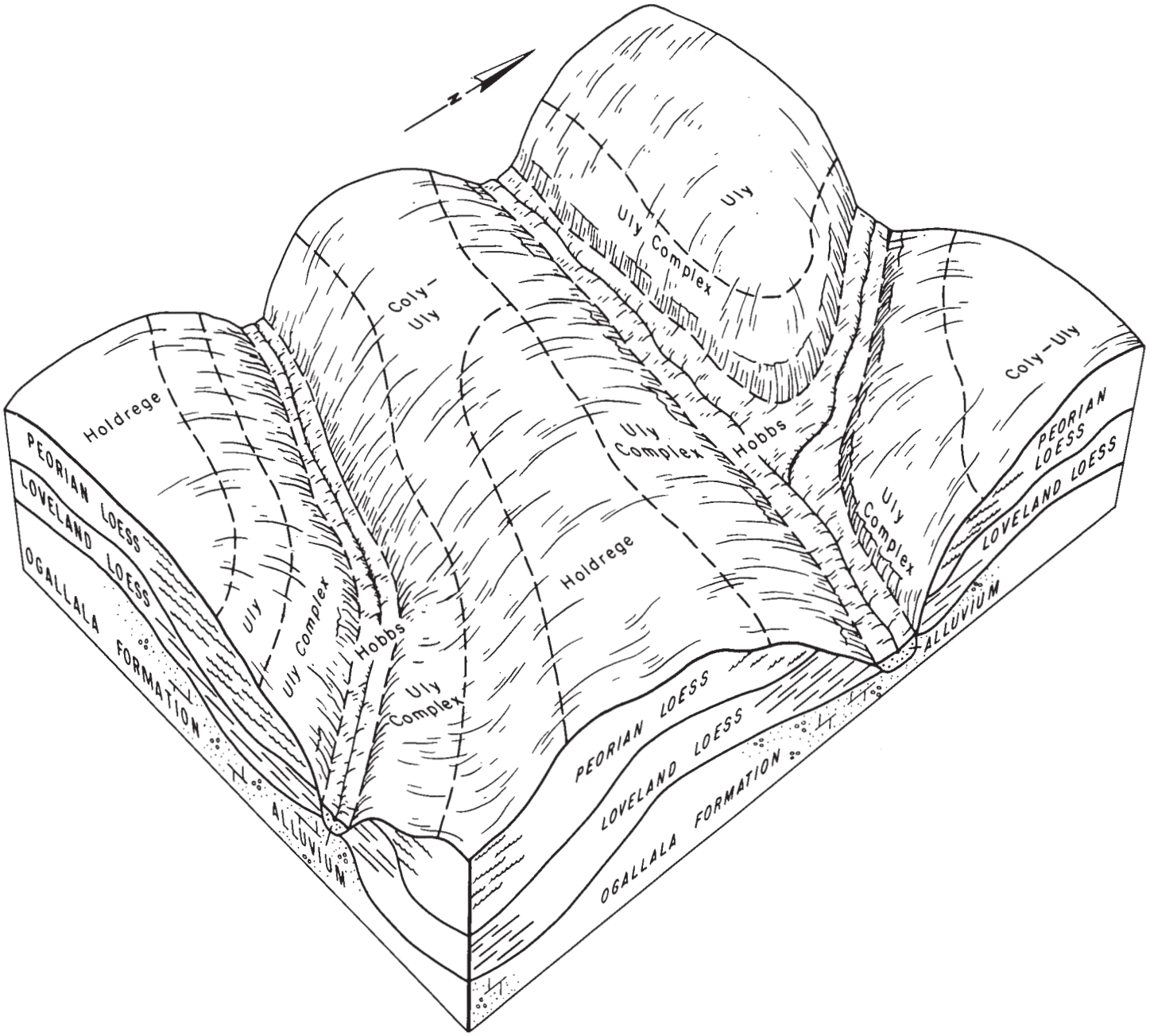


***Figure 2.*—Relationship of topography, soils, and underlying material in the Uly-Holdrege-Coly association.**

inches thick. The subsoil is 19 inches thick. It is grayish-brown silt loam in the upper 4 inches, light brownish-gray heavy silt loam in the middle 7 inches, and very pale brown, calcareous silt loam in the lower 8 inches. The underlying material, at a depth of 28 inches, is very pale brown, calcareous silt loam.

Holdrege soils are on loess-covered uplands. They are gently sloping or sloping and are well drained. The surface layer is about 11 inches thick. It is grayish-brown silt loam in the upper part and dark grayish-brown silt loam in the lower part. The subsoil is about 17 inches thick. The upper part of the subsoil is grayish brown silty clay loam, and the lower part is light brownish-gray silty clay loam. The underlying material, at a depth of 28 inches, is pale-brown, calcareous silt loam.

Coly soils are on loess-covered ridges and valley side slopes. They are sloping to moderately steep and are well drained and somewhat excessively drained. The surface layer is light brownish-gray, calcareous silt loam about 4 inches thick. Below this is light-gray, calcareous silt loam 6 inches thick. The underlying material is very pale brown, strongly calcareous silt loam. Coly soils are intermixed closely with Uly soils.

Minor soils in this association are Penden, Hobbs, and Roxbury soils. The Penden soils are sloping to moderately steep and are underlain by loamy sediment. They have short slopes and adjoin the drainageways. Hobbs soils occupy narrow areas along alluvial drainageways. Roxbury soils are along alluvial drainageways where calcareous silty outwash has accumulated from adjacent uplands.

The sloping to moderately steep soils of this association are better suited to range than to crops. Many areas that were once used for crops have been seeded back to native grass. Some areas of gently sloping or sloping Holdrege, Coly, and Uly soils on ridges and the upper parts of side slopes are suited to and used for crops. Winter wheat and sorghum are the main crops.

The available water capacity is high to very high in the Holdrege soils and very high in the Coly and Uly soils. Fertility is high in the Holdrege soils, medium in the Uly soils, and low in the Coly soils.

The main management needs for crops are conserving moisture, controlling runoff and soil blowing, and maintaining tilth and fertility. The main concern in management of range is maintaining a vigorous stand of desirable grass. Raising beef cattle and growing cash and forage crops are the main enterprises.

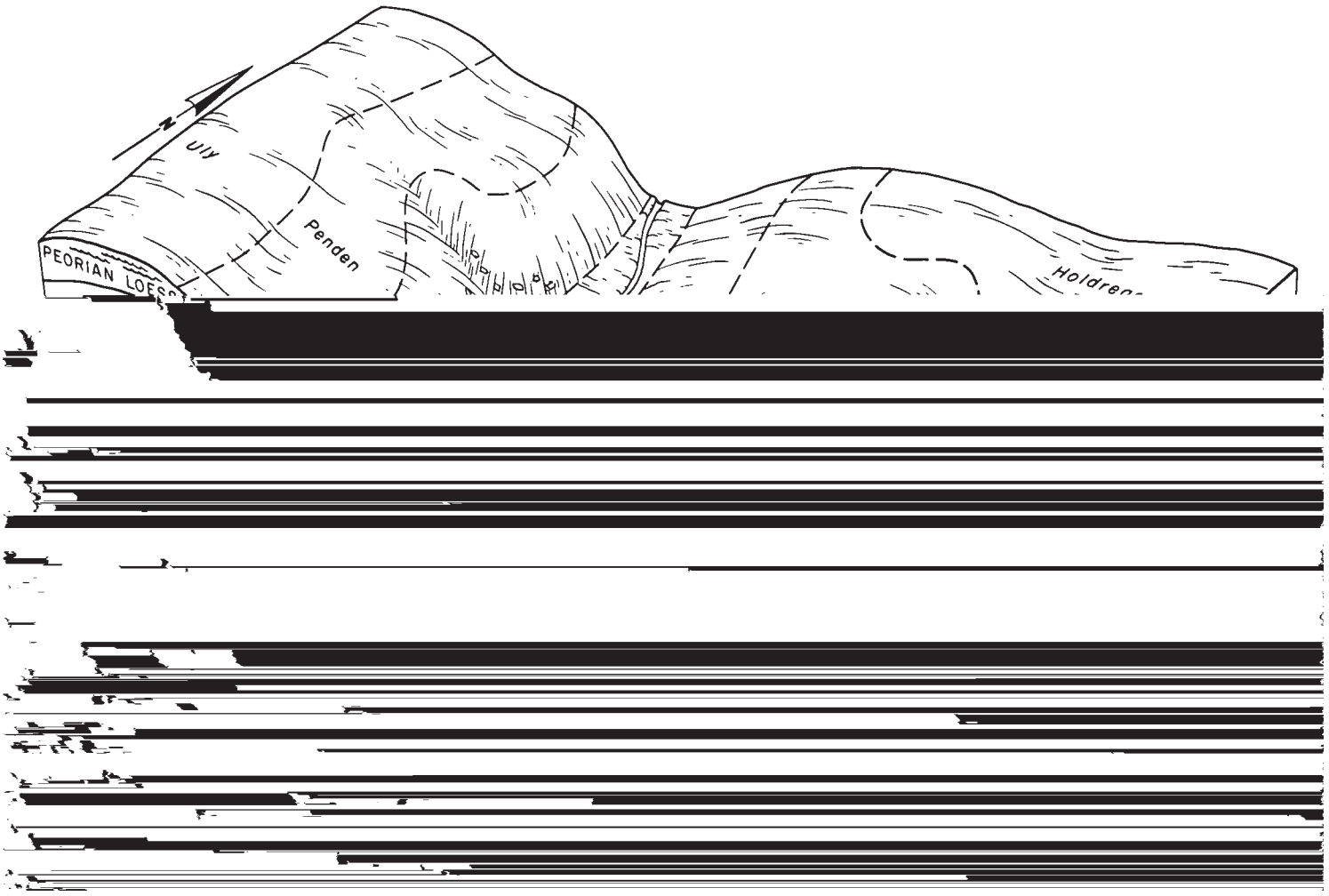
3. *Uly-Penden-Holdrege association*

Deep, gently sloping to moderately steep, well drained and somewhat excessively drained silt loams and loams on uplands

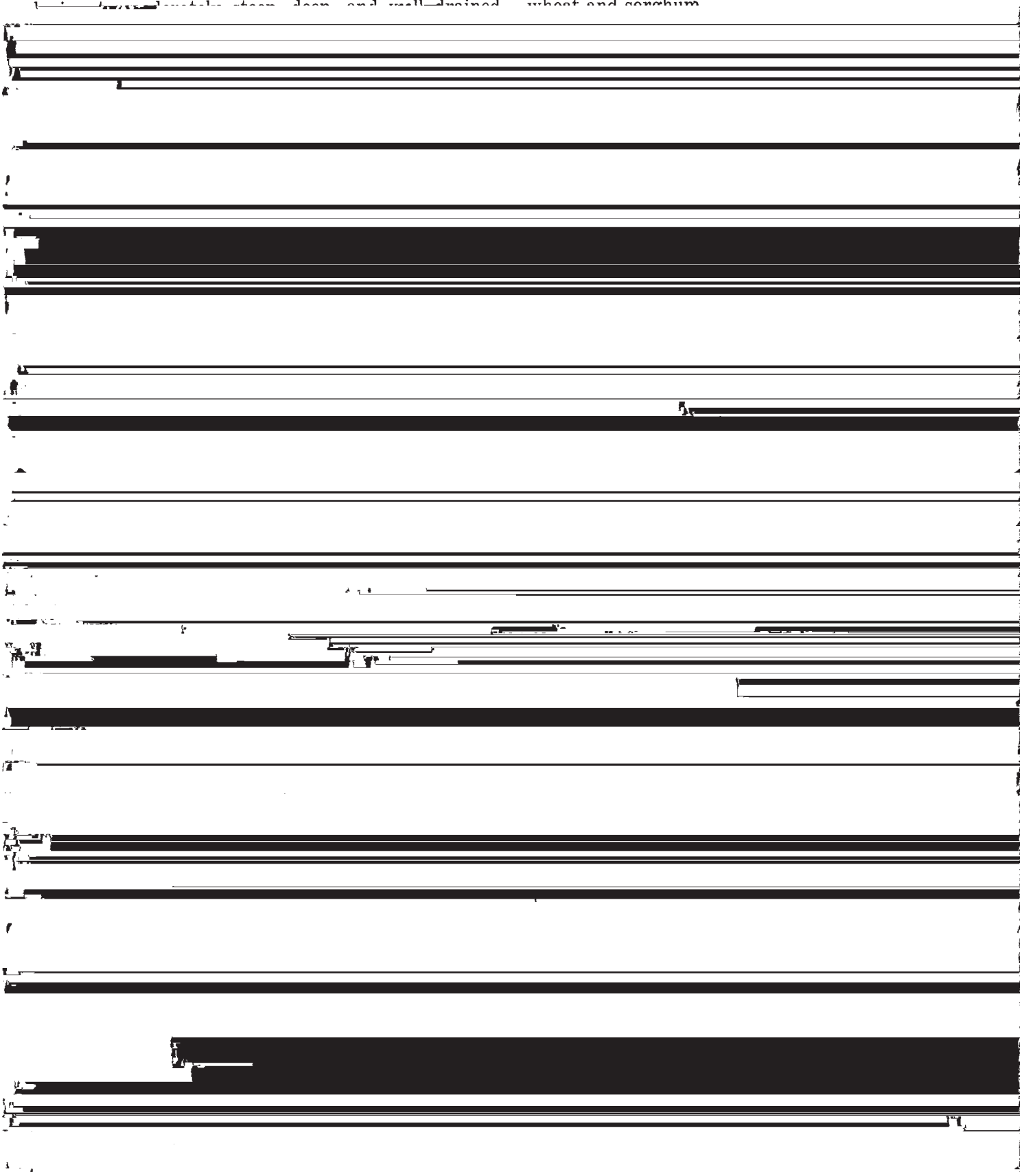
This soil association is on dissected, loess-covered uplands where gravelly and rocky outcrops are along the valley sides. The steeper soils are on the valley slopes, where partly consolidated caliche and sandy or gravelly material are exposed. The loess-covered ridges between the valleys are narrow, and the soils are gently sloping and sloping (fig. 3).

This association makes up about 20 percent of the county. It is about 45 percent Uly soils, 25 percent Penden soils, 20 percent Holdrege soils, and 10 percent minor soils.

Uly soils are on ridgetops and the upper part of side slopes. They are sloping and strongly sloping, deep, and well drained and somewhat excessively drained. The surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil is 19 inches thick. It is grayish-brown silt loam in the upper part, light-brownish-gray heavy silt loam in the middle part, and very pale brown, calcareous silt loam in the lower part. The underlying material, at a depth of 28 inches, is very pale brown, calcareous silt loam.



Penden soils formed in highly calcareous loamy material of valley slopes and gravelly breaks. They are [illegible] steep, deep, and well drained and road-surfacing material. Some areas of gently sloping soils along ridges are cultivated and used for wheat and sorghum.



Hord soils are on terraces. They are nearly level and are well drained and seldom flooded. They do receive some runoff, however, from adjacent uplands. These soils formed in alluvium that is thinly mantled with loess in some areas. The surface layer is silt loam about 16 inches thick. It is grayish brown in the upper part and dark grayish brown in the lower part. The subsoil is grayish-brown silt loam about 30 inches thick. The underlying material is light gray, calcareous silt loam

ping unit, it is necessary to read both the description of the mapping unit and the description of the series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar

soils are mapped only in a complex with the Canlon soils.

In a representative profile the surface layer is dark [illegible] loam, about 11 inches thick. The subsoil

Because the soils are sloping to steep, they are better suited to grazing than to farming. Most areas are in native grass and are used for grazing. These soils are well suited to wildlife that use range as habitat. Limi

or light clay loam 7 to 10 inches thick. The Cca horizon ranges from light gray to light brownish gray and is loam or light clay loam. Calcium carbonate occurs in the form of soft masses and small fragments of caliche and makes up about 25 to 50 percent of this horizon.

Campus soils are near Canlon, Penden, and Wakeen soils. They are deeper and have a thicker, darker colored A1 horizon than the Canlon soils. They are not so deep as the Penden soils, which formed in calcareous outwash. They are in areas similar to those occupied by the Wakeen soils, which are underlain by chalky limestone.

Cc—Campus-Canlon complex, 6 to 30 percent slopes. This mapping unit is on uplands and consists of sloping to steep soils that are underlain by caliche. It is about 45 percent Campus soil, 35 percent Canlon soil, 10 percent Penden soil, and 10 percent Uly soil and caliche outcrops. The Campus and Canlon soils have the profiles described as representative of their series.

Runoff is medium to rapid, and the hazard of erosion is severe.

The soils of this complex are better suited to range than to other uses because they have variable slopes, limited depth of root zone, and low available water capacity. In some places there are rock outcrops. Most of the acreage is used as range. The dominant vegetation is mid and short grasses. Deferred grazing, rota-

by caliche, but the Wakeen soils are underlain by chalky limestone. They formed in material weathered from caliche, but the Penden soils formed in loamy sediment.

Coly Series

The Coly series consists of deep, well drained to somewhat excessively drained, sloping to moderately steep soils on uplands. These soils formed in loess. Slopes range from 6 to 20 percent. The native vegetation is mainly short, mid, and tall grasses. The dominant grasses are big bluestem, little bluestem, side-oats grama, blue grama, and hairy grama. These soils are mapped only in an undifferentiated unit with the Uly soils.

In a representative profile the surface layer is light brownish-gray silt loam about 4 inches thick. Below that is light-gray, friable silt loam about 6 inches thick. The underlying material is very pale brown silt loam. The upper 15 inches of this material has common threads and soft masses of lime.

Permeability is moderate, the available water capacity is very high, and runoff is medium to rapid. Fertility is low.

Most areas of Coly soils are cultivated, but these soils are not well suited to crops because of the slope and the hazard of erosion. Many areas have been seeded back to native grass.

Representative profile of Coly silt loam, in an area of Coly and Uly silt loams, 6 to 10 percent slopes, eroded, in a cultivated field, 500 feet west and 250 feet north of the southeast corner of the southwest quarter of sec. 5, T. 2 S., R. 23 W.

Ap—0 to 4 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, granular structure; soft, friable; strongly effervescent; mildly alkaline; abrupt, smooth boundary.

AC—4 to 10 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, fine, granular structure; slightly hard, friable; many worm casts; strongly effervescent; moderately alkaline; gradual, smooth boundary.

C1ca—10 to 25 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium, granular structure; slightly hard, very friable; common worm casts; many root channels; common threads and soft masses of lime; strongly

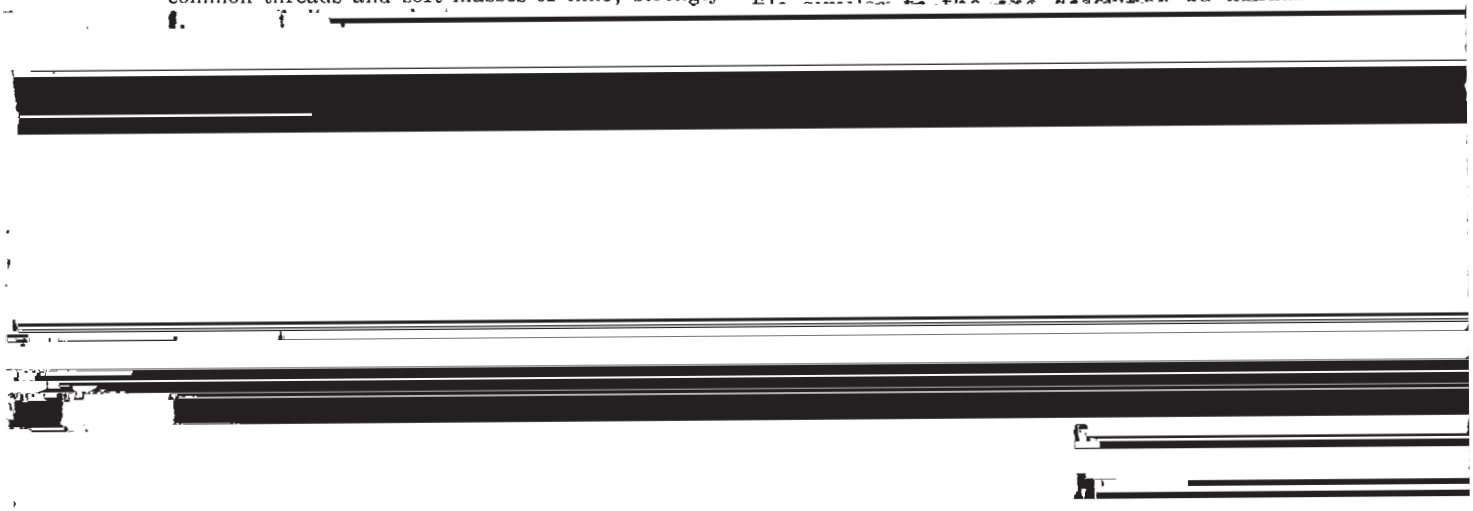
Co—Coly and Uly silt loams, 6 to 10 percent slopes, eroded. This mapping unit consists of sloping soils that are on uplands. The soils could be mapped individually but are shown as a differentiated group because, for the purpose of this survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of both. This Coly soil has the profile described as representative of the series. The Uly soil has a profile similar to the one described as representative of the Uly series, but in some places the surface layer is thinner because the soil is eroded.

Included with these soils in mapping are areas of Holdrege silt loam which make up about 8 percent of the mapping unit, and small, narrow areas of alluvial soil material in drainageways.

Runoff is medium to rapid, and the hazard of erosion is severe. The main concerns of management are conserving moisture, controlling water erosion and soil blowing, and maintaining tilth and fertility.

Much of the acreage is cultivated, but the soils are not well suited to crops because of the slope and the hazard of erosion. The main crops are wheat and sorghum. In most cultivated areas, water erosion has removed part of the surface layer, and tillage has mixed the lighter-colored subsoil with the remaining surface layer. Rills and shallow gullies have formed near the bottom of some slopes. Careful management of crop residue, terracing, contour farming, and stubble-mulch tillage help control further water erosion or soil blowing. Range seeding and proper grazing are needed in grassed areas. Dryland capability unit IVe–1; Coly soil in Limy Upland range site, Uly soil in Loamy Upland range site; windbreak suitability group 3.

Cs—Coly and Uly silt loams, 10 to 20 percent slopes, eroded. This mapping unit consists of strongly sloping to moderately steep soils that are on uplands. These soils could be mapped separately but are shown as one undifferentiated group because, for the purpose of this survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or both. The Coly soil has a pro-



further loss of soil material. Erosion impairs fertility and damages plants that do not have a well-established root system. Those areas now cultivated should be seeded to suitable native grass. Among the range management practices needed to produce adequate forage for livestock are proper stocking rates, water development, fencing, deferred grazing, and rotation of grazing. Dryland capability unit VIe–1; Coly soil in Limy Upland range site, Uly soil in Loamy Upland range site; windbreak suitability group 3.

massive, slightly hard, friable; strongly effervescent; moderately alkaline.

The solum ranges from 15 to 26 inches in thickness. The depth to free carbonates ranges from 0 to about 15 inches and averages about 13 inches.

The Ap horizon ranges from dark gray or dark grayish brown to gray or grayish brown. It is silt loam or loam about 6 to 8 inches thick. The A12 horizon ranges from dark gray or grayish brown to very dark gray or very dark grayish brown. It is silt loam or silty clay loam about 3 to 6 inches thick.

The B2 horizon ranges from gray to light brownish gray

Cozad Series

The Cozad series consists of deep, well-drained, nearly level to gently sloping soils on stream terraces and alluvial fans. These soils formed in silty alluvium

or grayish brown. It is silt loam to silty clay loam 6 to 9 inches thick.

The C1, ACcab, and C2 horizons all range from light gray or pale brown to light brownish gray or grayish brown and from silt loam to silty clay loam. A buried A1 horizon is in many profiles.

Cozad soils are near Hord, Detroit, and Roxbury soils.

capability unit IIe–2; Loamy Terrace range site; windbreak suitability group 1.

Detroit Series

The Detroit series consists of deep, well drained to moderately well drained, nearly level soils on stream terraces. These soils formed in silty alluvium modified by loess. Slopes are 0 to 1 percent. The native vegetation is mid and tall grasses.

In a representative profile the surface layer is dark grayish-brown and very dark grayish-brown light silty clay loam about 14 inches thick. The subsoil is about 24 inches thick. The upper 12 inches of the subsoil is very dark grayish-brown, very firm heavy silty clay [illegible] and the lower 12 inches is grayish-brown and 8 to 20 inches thick. The B3ca horizon is grayish-brown, light brownish-gray, or pale brown light to heavy silty clay loam about 10 to 12 inches thick

The C horizon is light brownish-gray, grayish-brown, or pale-brown silty clay loam to silt loam.

Detroit soils are near Hord, Roxbury, and Cozad soils. They are more clayey throughout than those soils. Detroit soils are leached of lime to a greater depth than the Roxbury and Cozad soils, and their dark colors extend to a greater depth than in the Cozad soils.

Dt—Detroit silty clay loam. This nearly level soil is on stream terraces. It has slopes of 0 to 1 percent.

Included with this soil in mapping are a few areas of Hord silt loam. Also included are a few areas of soils that have lime nearer the surface [illegible]

Runoff is slow to medium, and the hazard of erosion is slight.

C2—55 to 75 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable; mildly alkaline.

The solum is mildly alkaline or neutral throughout. The upper 40 inches of the soil do not contain free carbonates, except in some places where an upper layer 6 to 15 inches thick of recent deposition is calcareous. In most profiles stratification is evident from small discernible variations in color and clay content.

The Ap horizon is gray, grayish-brown, or dark grayish-brown silt loam or light silty clay loam 5 to 18 inches thick. The A12 horizon is grayish-brown or dark grayish-brown silt loam or light silty clay loam 15 to 25 inches thick.

The C horizon is light-gray, light brownish-gray, or grayish-brown silt loam or light silty clay loam. In some places it is mildly or moderately alkaline and slightly effervescent.

Hobbs soils are near Hord and Roxbury soils. They are leached of lime to a greater depth, are more stratified, and

Representative profile of Holdrege silt loam, 1 to 3 percent slopes, in a cultivated field, 246 feet east and 432 feet south of the northwest corner of the northeast quarter of sec. 34, T. 2 S., R. 24 W.

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; slightly hard, friable; many fine roots; slightly acid; abrupt, smooth boundary.

A3—6 to 11 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; slightly hard, friable; many fine roots; slightly acid; clear, smooth boundary.

B21t—11 to 15 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, very fine, subangular blocky

are 5 acres or less in size are shown on the detailed soil map by a spot symbol.

Runoff is slow to medium, and the hazard of erosion is slight. The soil blows when it is dry if it lacks a protective cover of residue or vegetation. Permeability is moderate.

The main crops are wheat and sorghum. A few areas are irrigated and used for corn. The main concern of management is the maintenance of soil tilth and fertility. Contour farming, stubble-mulch tillage, and stripcropping can be used to conserve moisture and control soil blowing. Land leveling is desirable if the soil is irrigated. Dryland capability unit IIc–1; irrigated capability unit I–1; Loamy Upland range site; windbreak suitability group 2.

Hp—Holdrege silt loam, 1 to 3 percent slopes. This gently sloping soil is in large broad areas that are dissected by upland drainageways. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of soils that have a more clayey subsoil, mainly in the eastern part of the county. Eroded soils in which the surface layer is thinner and lime is near the surface and a few depressions that are 5 acres or less in size are shown on the detailed soil map by the appropriate spot symbol.

erosion. Dryland capability unit IIe–1; irrigated capability unit IIe–1; Loamy Upland range site; windbreak suitability group 2.

Hs—Holdrege silt loam, 3 to 6 percent slopes. This sloping soil is on narrow ridges adjacent to the more sloping uplands. Most areas are relatively narrow. This soil has a profile similar to the one described as representative of the series, but the subsoil is less clayey, the combined surface layer and subsoil are generally thinner, and lime has not been so deeply leached.

Included with this soil in mapping are small areas of Uly soils along the crests of ridges and on the lower parts of slopes. Small areas of eroded soils, in which the surface layer is thinner and lime is nearer the surface, are shown on the detailed soil map by a spot symbol.

The hazard of erosion is moderate to severe.

Some areas of this soil are cultivated, but many areas are in native grass and are used for grazing. The main crops are wheat and sorghum. The main concern in managing cropped areas is controlling erosion and soil blowing. Terracing, contour farming, grassed waterways, and stubble-mulch tillage help conserve moisture and control soil blowing and water erosion. In areas used for range, deferred grazing, rotation grazing,

In a representative profile the surface layer is silt loam about 16 inches thick. The upper part of the surface layer is grayish brown, and the lower part is dark grayish brown (fig. 7). The subsoil is grayish-brown, friable silt loam about 30 inches thick. The underlying material is light-gray silt loam.

Permeability is moderate, the available water capacity is very high, and runoff is slow. Fertility is high.

Hord soils are well suited to farming and are well suited to wildlife that use open land as habitat. Limitations for many nonfarm uses are slight.

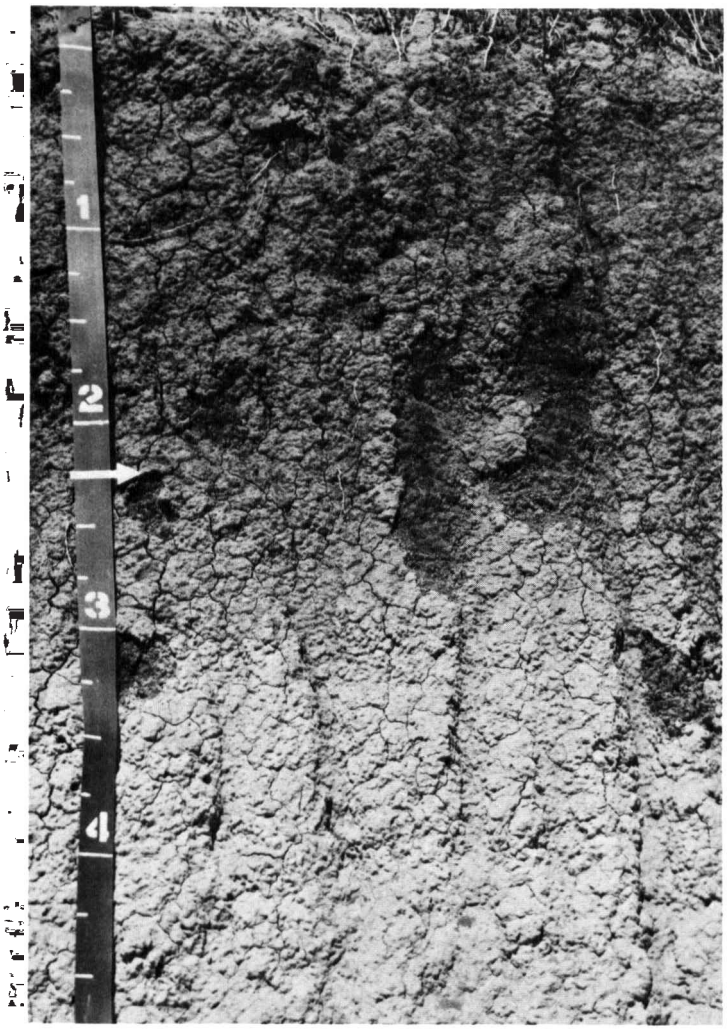
Representative profile of Hord silt loam, in a cultivated field, 1,000 feet east and 150 feet north of the center of sec. 4, T. 3 S., R. 23 W.

B2—16 to 30 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish-brown (10YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable; common worm casts; neutral; clear, smooth boundary.

B3—30 to 46 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable; mildly alkaline; clear, smooth boundary.

C—46 to 60 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable; strongly effervescent; moderately alkaline.

The solum is neutral in the upper part and neutral or mildly alkaline in the lower part. The A horizon ranges from dark gray or dark grayish brown to gray or grayish brown and is about 10 to 18 inches thick. It is generally



Scattered deciduous trees grow in some areas but are not native.

vegetation. Stubble-mulch tillage helps conserve moisture and control soil blowing. Dryland capability unit

thick. The C1ca horizon ranges from about 15 to 22 percent free carbonates.

Penden soils are near Campus, Wakeen, Canlon, Coly, Holdrege, and Uly soils. Penden soils are deeper than

The C horizon ranges from grayish-brown or brown to light-gray or very pale brown silt loam to loam. In some places the C horizon has strata of fine sandy loam below a depth of 40 inches.

coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; common coatings and threads of lime; strongly effervescent; moderately alkaline; gradual, wavy boundary.

C—28 to 60 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard, friable; few large roots and root channels; common coatings and threads of lime; strongly effervescent; moderately alkaline.

The depth to free carbonates is typically more than 8

or less in size, are shown on the soil map by a spot symbol.

Runoff is rapid, and the hazard of erosion is severe.

areas are in native grass. Because the soils are sloping and moderately deep, they have moderate to severe limitations for many nonfarm uses.

Representative profile of Wakeen silt loam, in range.

Use and Management of the Soils

have long slopes. Each row planted on the contour acts

The soils of Norton County are used mainly for

it soak into the soil. The water that is saved by terrac-

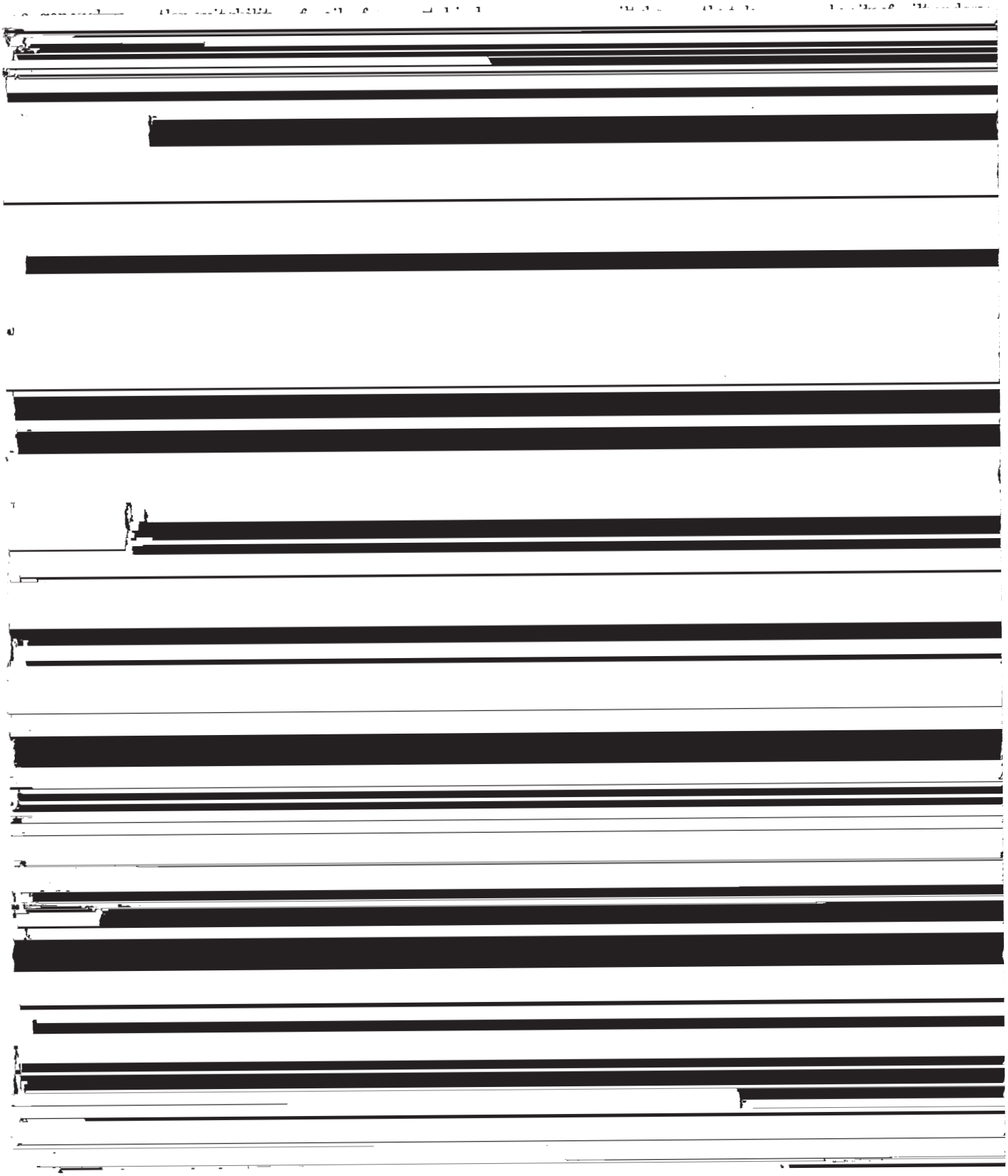
management practices needed on a particular soil. Wheat and other close-growing crops provide more protection for the soil than row crops, and the residue from wheat provides more protection than the residue from grain sorghum.

Management of Soils for Irrigated Crops [3]

The factors to be considered in planning an irrigation system are the characteristics and properties of the soil, the quality and quantity of irrigation water available, the crops to be irrigated, and the type of irrigation system to be used. It is especially important to know the quality of the irrigation water so that the

drainage, slope, and susceptibility to stream overflow. All of these must be considered in designing the irrigation system. (fig. *10*). The frequency of irrigation depends on the requirements of the crop and the available water capacity of the soil. The available water capacity is determined mainly by the depth and texture of the soil. Permeability affects the rate at which water enters the soil, as well as the internal drainage. The rate of water intake is also affected by the condition of the surface layer.

The soil survey has determined the characteristics of each soil in the county. Permeability and available water capacity are listed for each soil in table 6 in the section "Engineering Uses of the Soils." Soil features



duce the choice of plants, require special conservation practices, or both.

Subclass IIIe. Soils that are subject to severe erosion if they are cultivated and not protected.

Unit IIIe–1. Deep, sloping, well-drained silt loams that have a subsoil of silty clay loam; on uplands.

Subclass IIIw. Soils that are severely limited for cultivation because of excess water.

[redacted]

Unit IIIw–1. Deep, nearly level, well [redacted] habitat. (None in Norton County.)

[redacted]

drained to somewhat excessively drained loams and silt loams; on uplands.

Unit VIe–3. Moderately deep and shallow, sloping to steep, well-drained to somewhat excessively drained loams and silt loams; on uplands.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and restrict their use largely to range, woodland, or wildlife

[redacted]

Class VIII. Soils and landforms that have limitations

[redacted]

requirements for optimum efficiency in crop production.

6. Terraces, contour farming, grassed waterways, stubble-mulch tillage, and summer fallow are used to conserve moisture and control runoff.
7. Cropping systems and crop residue manage-

moisture during the first few days. This moisture can be provided by diverting runoff from other areas, by hauling irrigation water from wells, or by using diversion terraces. Livestock should be excluded from the windbreaks. Practices other than burning are needed to remove the accumulation of loose weeds and trash

TABLE 3.—*Suitability of trees and shrubs for windbreaks*

[The windbreak suitability group for each soil in Norton County is listed at the end of the mapping unit description and in the "Guide to Mapping Units." The estimated height is for trees and shrubs at 20 years of age. The estimated height is not given if the rating is poor]

Trees and shrubs	Windbreak suitability groups					
	Group 1		Group 2		Group 3	
	Vigor	Height	Vigor	Height	Vigor	Height
		Feet		*Feet*		*Feet*
Conifers:						
Eastern redcedar	Excellent	25	Excellent	23	Good	18
Rocky Mountain juniper	Good	30	Good	25	Poor.	
Ponderosa pine	Excellent	30	Fair to good	24	Fair	20
Austrian pine	Excellent	30	Excellent	30	Fair	15
Tall trees:						
Cottonwood	Excellent	45	Fair	30	Poor.	
Siberian elm	Excellent	45	Good	35	Fair	30
Medium trees:						
Green ash	Fair	30	Fair	26	Poor.	
Hackberry	Excellent	30	Fair	21	Fair	19
Bur oak	Excellent	30	Fair	25	Fair	20
Honeylocust	Good	30	Good	25	Fair	20
Short trees:						
Russian-olive	Good	20	Good	15	Fair	15
Russian mulberry	Excellent	17	Good	15	Good	15
Osageorange	Excellent	20	Excellent	18	Good	15
Shrubs:						
American plum	Excellent	8	Excellent	8	Good	5
Tamarack	Excellent	10	Good	10	Poor.	
Common lilac	Excellent	8	Excellent	8	Poor.	
Skunkbush sumac	Excellent	6	Excellent	6	Excellent	6
Cotoneaster	Excellent	7	Good	7	Good	6

38 percent of the land area in the county, or 203,640 acres, is range.

In addition to producing pasture and hay for livestock, range supplies food and cover for wildlife. Well-managed range contributes to flood control when a large amount of precipitation seeks into the root zone

classes show the present condition of the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to

short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily they increase rapidly. Woody plants, common along stream channels, also increase.

SANDY LOWLAND RANGE SITE

This site consists of deep, nearly level to gently undulating soils of the Munjor series on flood plains adjacent to the North Fork Solomon River. They have a sandy loam surface layer and a coarse-textured subsoil. Permeability is rapid. If not protected, these soils are highly susceptible to soil blowing.

Sand bluestem makes up about 35 percent, by weight, of the climax plant community; switchgrass and little bluestem each make up 15 percent; indiangrass makes up 10 percent; western wheatgrass, Illinois bundleflower, and woody plants each make up 5 percent; side-oats grama and maximillian sunflower each make up 3 percent; and sand dropseed and roundhead lespedeza each make up 2 percent.

Sand bluestem, indiangrass, switchgrass, and little bluestem decrease if the site is overgrazed. Palatable forbs, maximillian sunflower, roundhead lespedeza, and Illinois bundleflower also decrease. Western wheatgrass, side-oats grama, blue grama, and sand dropseed increase. Louisiana sagewort, baldwin ironweed, western ragweed, and tall goldenrod make up a very small part of the climax plant community, but they increase rapidly. Woody plants also increase.

Woody plants, mainly cottonwood and willow, are common along stream channels. Sand plum is in small, scattered mottles over the site and is not confined to stream banks.

If the site is in excellent condition, the average annual production of air-dry herbage is 4,500 pounds per acre in years of favorable moisture and 3,000 pounds per acre in years of unfavorable moisture.

SHALLOW LIMY RANGE SITE

This site consists of sloping to steep soils of the Canlon series on uplands. They have a loamy surface layer that is 4 to 20 inches thick and is underlain by limestone. Permeability is moderate to slow, and the available water capacity is high. Because of the rough and broken topography and the many vertical ledges, travel is difficult for livestock.

Little bluestem makes up about 25 percent, by weight, of the climax plant community; big bluestem makes up 20 percent; side-oats grama makes up 15 percent; plains muhly makes up 10 percent; blue grama and hairy grama together make up 10 percent; switchgrass and leadplant each make up 5 percent; and resinous skullcap, black sampson, prairieclover, western ragweed, and smooth sumac each make up 2 percent.

Big bluestem, little bluestem, plains muhly, switchgrass, and leadplant decrease if the site is overgrazed. Side-oats grama, blue grama, hairy grama, buffalograss, and western ragweed increase. If the site is over-

Farms and cultivated areas are a major habitat for many different kinds of wildlife (fig. 11). Cottontail rabbit, fox squirrel, mourning dove, songbirds, and bobwhite quail are typical of wildlife that inhabit farmed areas or open land in Norton County. The mixed areas of range and cultivated fields in the county provide habitat for good populations of birds and mammals.

Proper pasture and range management is essential to optimum livestock and wildlife populations. In judging pasture or range, all factors that affect streamflow, siltation, available water, wildlife, and recreation must be evaluated.

The effect of livestock grazing on wildlife may be competitive, beneficial, or neutral, depending on such factors as the type of vegetation, kind and combination of livestock, topography, soils, and availability of water.

Wildlife populations increase where animals can find food, water, and cover within a small area. More kinds of wildlife can survive where different cover types are broken up and mixed together.

Many farm ponds are scattered throughout the county; most serve both livestock and wildlife. The major lake in the county is Norton Reservoir, and the major rivers and creeks are North Fork Solomon River, Sappa Creek, and Prairie Dog Creek. Fishing is good in Norton County.

In table 4, the soils in Norton County are rated for eight elements of wildlife habitat and for three kinds of wildlife. The kinds of wildlife are defined in the following paragraphs.

Openland wildlife are animals that inhabit cultivated areas, pastures, meadows, lawns, and areas overgrown with grasses, herbs, shrubs, and vines. Bobwhite quail, pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, red fox, and woodchuck are examples of openland wildlife.

Wetland wildlife are animals that inhabit swampy,

TABLE 4.—*Suitability of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Campus: Cc For the Canlon part, see the Canlon series.	Fair	Fair	Good	Fair
Canlon Mapped only in a complex with Campus soils.	Poor	Fair	Fair	Poor
Coly: Co, Cs For the Uly part, see the Uly series.	Fair where slopes are less than 10 percent. Poor where slopes are more than 10 percent.	Good where slopes are less than 10 percent. Poor where slopes are more than 10 percent.	Fair	Poor
Cozad: Cu, Cz	Good	Good	Good	Good
Detroit: Dt	Good	Good	Good	Good
Hobbs: Hb	Good	Good	Good	Good
Holdrege: Ho, Hp, Hr, Hs, Ht	Good where slopes are less than 3 percent. Fair where slopes are more than 3 percent.	Good	Good	Good
Hord: Hz	Good	Good	Good	Good
Munjor: Mu	Good	Good	Good	Good
Penden Mapped only in a complex with Uly soils.	Fair where slopes are less than 7 percent. Poor where slopes are more than 7 percent.	Fair	Good	Fair
Roxbury: Rx	Good	Good	Good	Good
Uly: Ub, Uc, Up For the Penden part of Up, see the Penden series.	Fair where slopes are less than 10 percent. Poor where slopes are more than 10 percent.	Good where slopes are less than 10 percent. Fair where slopes are more than 10 percent.	Good	Fair
Wakeen: Wa	Fair	Good	Fair	Fair

marshy, or open water areas. Duck, geese, heron, shorebirds, rail, kingfisher, muskrat, and beaver are examples of wetland wildlife.

Rangeland wildlife are animals that inhabit natural range. Antelope, mule deer, bison, prairie chicken, coyote, jackrabbit, prairie dog, and lark bunting are examples of rangeland wildlife.

Further information and assistance in planning and developing wildlife habitat can be obtained at the local

Use of the Soils for Recreation [6]

Prairie Dog State Park, which is 5 miles southwest of Norton, is an area of 1,578 acres adjacent to Norton Reservoir. The reservoir has a surface area of 2,330 acres. Fishing, hunting, camping, picnicking, boating, water skiing, hiking, and swimming are some of the activities provided by this facility.

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table

of wildlife habitat and kinds of wildlife

Elements of wildlife habitat—Continued				Openland wildlife	Wetland wildlife	Rangeland wildlife

TABLE 5.—*Degree and kind of limitations of the soils for recreation development*

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Campus: Cc For the Canlon part, see the Canlon series.	None to slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	None to slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: slopes are more than 6 percent; caliche beds at a depth of 20 to 40 inches.	None to slight where slopes are less than 15 percent. Moderate where slopes are more than 15 percent.
Canlon Mapped only in a complex with Campus soils	None to slight where slopes are less than 8 percent.	None to slight where slopes are less than 8 percent.	Severe: slopes are more than 6 percent; hard caliche at a depth of	None to slight where slopes are less than 15 percent.

stones or boulders that greatly increase the cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The soils that are best suited to playgrounds have a nearly level surface that is free of coarse fragments and rock outcrops, good drainage, and a surface that is firm when wet but not dusty when dry. Also, flooding does not occur during periods of heavy use. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or on horseback. Design and layout should require little or no cutting and filling. The soils

Most of the information in this section is presented in tables. Table 6 shows several estimated soil properties significant in engineering; table 7 shows interpretations for various engineering uses; table 8 shows suitability of the soils as a source of construction material; and table 9 gives the results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 6, 7, and 8 and also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavation to a depth greater

TABLE 6.—*Estimated soil properties*

[An asterisk in the first column means that at least one mapping unit in this series is made up of two or more kinds of soil. The The symbol >

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification	
	Bedrock	Seasonal high water table			Unified	AASHTO
	Inches	*Feet*	*Inches*			
*Campus: Cc	20–40	> 6	0–11	Loam	ML or CL	A–6 or A–7–6
For the Canlon part, see the Canlon series.			11–30	Loam, clay loam.	CL, SC	A–6 or A–7–6
			30	Caliche.		
Canlon	10–20	> 6	0–13	Loam, fine sandy loam.	CL	A–4 or A–6
Mapped only in a complex with Campus soils.			13	Hard caliche.		
*Coly: Co, Cs	> 60	> 10	0–10	Silt loam	ML or CL	A–4 or A–6
For the Uly part, see the Uly series.			10–60	Silt loam	ML or CL	A–4 or A–6
Cozad: Cu, Cz	> 60	> 6	0–13	Silt loam	ML or CL	A–4 or A–6
			13–60	Silt loam, silty clay loam.	ML or CL	A–6 or A–4
Detroit: Dt	> 60	> 6	0–14	Silty clay loam	CL	A–6 or A–7
			14–26	Heavy silty clay loam.	CH or CL	A–7
			26–60	Silty clay loam	CL	A–4 or A–6
Hobbs: Hb	> 60	> 6	0–25	Silt loam	ML or CL	A–4 or A–6
			25–60	Silt loam	ML or CL	A–6 or A–4
Holdrege: Ho, Hp, Hr, Hs, Ht	> 60	> 6	0–11	Silt loam	ML or CL	A–4 or A–6
			11–22	Silty clay loam	CL or CH	A–6 or A–7–6
			22–60	Silt loam	CL or ML	A–4, A–6, or A–7
Hord: Hz	> 60	> 6	0–16	Silt loam	ML or CL	A–4 or A–6
			16–30	Silt loam or light silty clay loam.	ML or CL	A–4, A–6, or A–7
			30–60	Silt loam	ML or CL	A–4 or A–6
Munjor: Mu	> 60	> 5	0–15	Sandy loam	SM	A–2–4
			15–60	Sandy loam	SM	A–2–4
Penden	> 60	> 5	0–10	Loam	CL	A–6 or A–7–6
Mapped only in a complex with Uly soils.			10–24	Loam	CL	A–6
			24–60	Loam	CL	A–6
Roxbury: Rx	> 60	> 5	0–36	Silt loam	ML-CL or CL	A–4 or A–6
			36–60	Silt loam	CL or ML	A–4 or A–6

significant in engineering

soils in such mapping units can have different properties, and for this reason it is necessary to refer to other series as indicated. means more than]

Percentage of material smaller than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Percent		*Inches per hour*	*Inches per inch of soil*	*pH*			
90–100	90–100	75–95	50–80	35–45	11–20	0.6–2.0	0.20–0.22	7.4–8.4	Low	Low	Low.
90–100	85–100	65–85	40–80	35–45	15–20	0.6–2.0	0.15–0.19	7.4–8.4	Low	Low	Low.
90–100	85–100	85–100	65–85	25–40	8–20	0.6–2.0	0.12–0.16	7.4–8.4	Low	Low	Low.
100	100	95–100	90–100	25–40	4–20	0.6–2.0	0.20–0.22	7.4–8.4	Low	Low	Low.
100	100	100	95–100	25–40	4–20	0.6–2.0	0.20–0.22	7.4–8.4	Low	Low	Low.
100	100	90–100	90–100	20–35	8–18	0.6–2.0	0.22–0.24	6.6–8.4	Low	Low	Low.
100	100	100	95–100	25–40	8–20	0.6–2.0	0.20–0.22	7.4–8.4	Low	Low	Low.
100	100	95–100	85–95	30–45	11–24	0.2–0.6	0.21–0.23	6.1–7.3	Low to moderate.	Moderate	Low.
100	100	95–100	90–100	40–55	20–30	0.06–0.2	0.11–0.13	6.1–7.3	Moderate to high.	Moderate to high.	Low.
100	100	95–100	85–95	35–45	18–24	0.2–0.6	0.18–0.20	6.6–8.4	Moderate	Moderate	Low.
100	100	95–100	90–100	30–40	8–15	0.6–2.0	0.22–0.24	6.1–7.3	Low	Low	Low.
100	100	95–100	90–100	30–40	8–15	0.6–2.0	0.20–0.22	6.6–7.8	Low	Low	Low.
100	100	98–100	90–100	24–40	2–14	0.6–2.0	0.22–0.24	6.1–7.0	Low	Low	Low.
100	100	98–100	95–100	30–55	20–35	0.6–2.0	0.18–0.20	6.1–7.3	Low to moderate.	Low	Low.
100	100	98–100	95–100	30–45	5–20	0.6–2.0	0.20–0.22	7.3–8.4	Low to moderate.	Low	Low.
100	100	98–100	90–100	20–40	6–15	0.6–2.0	0.22–0.24	6.6–7.3	Low	Low	Low.
100	100	100	95–100	25–45	8–25	0.6–2.0	0.20–0.22	6.6–7.3	Low to moderate.	Low	Low.
100	100	100	95–100	20–40	6–15	0.6–2.0	0.20–0.22	7.4–8.4	Low	Low	Low.
100	95–100	60–70	20–35	20–35	3–7	2.0–6.0	0.13–0.15	7.4–8.4	Low	Low	Low.
95–100	90–95	55–70	15–35	20–35	3–7	6.0–20	0.11–0.13	7.4–8.4	Low	Low	Low.
100	100	90–100	70–95	35–45	15–25	0.2–2.0	0.20–0.22	7.4–8.4	Low to	Low to	Low.

TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification	
	Bedrock	Seasonal high water table			Unified	AASHTO
	Inches	*Feet*	*Inches*			
*Uly: Ub, Uc, Up	> 60	> 10	0–13	Silt loam	ML or CL	A–4 or A–6
			13–20	Silt loam	ML-CL or CL	A–4 or A–6
			20–60	Silt loam	ML-CL or CL	A–4 or A–6
Wakeen: Wa	20–40	> 6	0–8	Silt loam	CL	A–6 or A–7
			8–20	Silt loam	CL	A–4, A–6, or A–7
			20–38	Silt loam	CL	A–6, A–4, or A–7–6
			38	Chalky limestone.		

For the Penden part of Up, see the Penden series.

index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 9; the estimated classification, without group index numbers, is given in table 6 for all soils mapped in the survey area.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 6. These estimates are made for representative soil profiles, by layers having significantly different soil properties. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 6.

Depth to bedrock is the distance from the surface of the soil to a rock layer within the depth of observation.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

terial. As the moisture content of a clayey soil from which the particles coarser than 0.42 millimeter have been removed is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic state, and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of water content within which soil material is plastic. Liquid limit and plasticity index are estimated in table 6, but in table 8 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability, as used here, is an estimate of the rate at which saturated soil transmits water downward under a unit head of pressure. It is estimated on the basis of soil characteristics observed in the field, particularly structure, porosity, and texture. Lateral seepage and transient soil features, such as plowpans and surface crusts, are not considered.

Available water capacity is an estimate of the ca-

significant in engineering—Continued

Percentage of material smaller than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
										Uncoated	

TABLE 7.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. series as indicated in the

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings	Local roads and streets
*Campus: Cc For the Canlon part, see the Canlon series.	Severe: caliche beds at a depth of 20 to 40 inches.	Severe: slopes are more than 7 percent in most places; caliche beds at a depth of 20 to 40 inches.	Moderate: rippable caliche beds at a depth of 20 to 40 inches.	Moderate where slopes are 8 to 15 percent: caliche beds at a depth of 20 to 40 inches. Severe where slopes are more than 15 percent.	Moderate where slopes are 8 to 15 percent: caliche beds at a depth of 20 to 40 inches. Severe where slopes are more than 15 percent.
Canlon Mapped only in a complex with Campus soils.	Severe: caliche at a depth of 10 to 20 inches.	Severe: slopes are more than 7 percent in most places; caliche at a depth of 10 to 20 inches.	Severe: caliche at a depth of 10 to 20 inches.	Severe: caliche at a depth of 10 to 20 inches.	Severe: caliche at a depth of 10 to 20 inches.
*Coly: Co, Cs For the Uly part, see the Uly series.	Slight where slopes are less than 8 percent. Moderate where	Moderate where slopes are less than 7 percent: moderate	Slight where slopes are less than 8 percent. Moderate where	Slight where slopes are less than 8 percent.	Moderate where slopes are less than 15 percent:

properties of the soils

The soils in such mapping units can have different properties and limitations, and for this reason it is necessary to refer to other first column of this table]

Degree and kind of limitations for—Continued		Soil features affecting—				
Sanitary landfill (trench type)[1]	Sanitary landfill (area type)	Highway location	Pond reservoir areas	Embankments, dikes, and levees	Terraces, diversions, and waterways	Irrigation
Severe: caliche beds at a depth of 20 to 40 inches.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	High erodibility; slopes of 6 to 30 percent; caliche at a depth of 20 to 40 inches.	Caliche at a depth of 20 to 40 inches; slopes of 6 to 30 percent.	Limited borrow material; fair stability and compaction characteristics.	Caliche at a depth of 20 to 40 inches; slopes of 6 to 30 percent.	Caliche at a depth of 20 to 40 inches; slopes of 6 to 30 percent.
Severe: caliche at a depth of 10 to 20 inches.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	High erodibility; slopes of 6 to 30 percent; caliche at a depth of 10 to 20 inches.	Caliche at a depth of 10 to 20 inches; slopes of 6 to 30 percent.	Shallow soil	Caliche at a depth of 10 to 20 inches; slopes of 6 to 30 percent.	Caliche at a depth of 10 to 20 inches; slopes of 6 to 30 percent.
Slight where slopes are less than 15 percent. Moderate where slopes are more than 15 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	High erodibility; slopes of 6 to 20 percent.	Slopes of 6 to 20 percent.	Fair stability; high erodibility.	High erodibility; excessive slopes; low fertility.	Generally not irrigated: most slopes are too steep; very high available water capacity; moderate intake rate.
Slight	Slight	No unfavorable features; nearly level.	Low to moderate risk of seepage.	Slopes are erodible; moderate hazard of piping.	Slopes are erodible.	Very high available water capacity; moderate intake rate.
Moderate: silty clay loam.	Slight	No unfavorable features; nearly level.	Slow permeability.	Low shear strength; moderate to high shrink-swell potential.	Nearly level; silty clay loam subsoil.	Nearly level.
Severe: subject to frequent flooding.	Severe: subject to frequent flooding.	Subject to frequent flooding.	Moderate permeability.	Fair to good stability and compaction characteristics; medium compressibility.	Subject to frequent flooding.	Subject to frequent flooding.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings	Local roads and streets
Munjor: Mu	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate to severe: subject to flooding.
Penden Mapped only in a complex with Uly soils.	Moderate where slopes are less than 15 per-	Moderate where slopes are less than 7 percent:	Slight where slopes are less than 8	Moderate where slopes are less than 15	Moderate where slopes are less than 15

properties of the soils—Continued

Degree and kind of limitations for—Continued		Soil features affecting—				
Sanitary landfill (trench type)[1]	Sanitary landfill (area type)	Highway location	Pond reservoir areas	Embankments, dikes, and levees	Terraces, diversions, and waterways	Irrigation
Severe: subject to flooding.	Severe: subject to flooding.	Subject to flooding; nearly level.	Moderately rapid permeability.	Pervious material; good shear strength.	Sandy loam	Sandy loam; rapid intake rate.
Slight where slopes are less than 15 percent. Moderate where slopes are more than 15 percent.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Moderate erodibility.	Moderate permeability; slopes of 6 to 20 percent.	Low to moderate shrink-swell potential; fair to good stability and compaction characteristics.	Slopes of 6 to 20 percent.	Slopes of 6 to 20 percent.
Severe: subject to flooding.	Severe: subject to flooding.	Nearly level; subject to flooding.	Moderate permeability; subject to flooding.	Fair compaction characteristics; medium to low shear strength.	Moderate permeability; subject to flooding; nearly level.	Very high available water capacity; moderate permeability; subject to flooding.
Slight where slopes are less than 15 percent. Moderate where slopes are	Slight where slopes are less than 8 percent. Moderate where slopes are 8	Moderate erodibility; slopes of 6 to 20 percent.	Fair to poor bank stability; slopes of 6 to 20 percent.	Fair bank stability and compaction characteristics; fair resistance to piping.	No unfavorable features; exposed subsoil is erodible and has low fertility; slopes	No unfavorable features; severe hazard of erosion on slopes of 6 to 20 percent.

TABLE 8.—*Suitability of the soils as a source of construction materials*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units can have different properties and limitations, and for this reason it is necessary to refer to other series a sindicated in the first column of this table]

Soil series and map symbols	Sanitary landfill cover material	Topsoil	Sand and gravel	Road subgrade	Road fill
*Campus: Cc ..... For the Canlon part, see the Canlon series.	Poor: caliche at a depth of 20 to 40 inches; slopes of 6 to 30 percent; area difficult to reclaim.	Poor: area difficult to reclaim.	Poor except for local pockets.	Poor: low soil support.	Fair: fair shear strength.
Canlon ..... Mapped only in a complex with Campus soils.	Poor: caliche at a depth of 10 to 20 inches.	Poor: more than 15 percent coarse fragments; caliche at a depth of 10 to 20 inches.	Poor except for local pockets.	Poor: low soil support.	Fair: fair shear strength.
*Calva Cr [illegible]	[illegible]	Fair where slopes are less	Unsuited	Fair:	Good

compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some properties that affect suitability for landfill are ease of excavation, hazard of pollution of ground water, and trafficability. The soils that are best suited to sanitary landfill have moderately slow

tion of the water table, or other factors that affect mining of the materials, and they do not indicate the quality of the deposit.

The soil support ratings for road subgrade indicate the ability of the soil material to support a load under vehicular traffic. The ratings are based on the liquid

TABLE 9.—*Engineering*

[Tests performed by the State Highway Commission of Kansas according to standard procedures of the

Soil name and location	Parent material	Kansas report no. S–71–	Depth	Moisture-density data [1]	
				Maximum dry density	Optimum moisture
			Inches	*Pounds per cubic foot*	*Percent*
Holdrege silt loam:					
1,425 feet west and 150 feet south of the northeast corner of section 20, T. 2 S., R. 23 W. About 2 miles west and 3 miles north of Norton. (Modal)	Peorian loess.	69–1–1	0–6	101	19
		69–1–2	14–23	101	19
		69–1–3	31–45	103	17
		69–1–4	45–60	104	18
Uly silt loam:					
850 feet west and 640 feet north of the southeast corner of the NE¼ of section 3, T. 1 S., R. 23 W. About 10 miles north of Norton. (Modal)	Peorian loess.	69–2–1	0–9	98	19
		69–2–2	13–20	104	18
		69–2–3	28–60	106	16
Hord silt loam:					
1,000 feet south and 120 feet west of the northeast corner of the SE¼ of section 22, T. 3 S., R. 24 W. About 6 miles west and 4 miles south of Norton. (Modal)	Loess and alluvium.	69–3–1	0–15	102	18
		69–3–2	15–25	99	19
		69–3–3	40–60	104	18

[1] Based on AASHTO Designation T 99–61, Method A (*1*), with the following variations: (1) all material is ovendried at 230°F. and crushed in a laboratory crusher after drying, and (2) no time is allowed for dispersion of moisture after mixing with soil material.

[2] Mechanical analyses according to AASHTO Designation T 88–70 (*1*), with the following variations: (1) all material is ovendried at 230°F. and crushed in a laboratory crusher; (2) the sample is not soaked prior to dispersion; (3) sodium hexametaphosphate buffered with Na_2Co_3 is used as the dispersing agent; and (4) dispersing time, in minutes, is established by dividing the plasticity index value by 2; the maximum time is 15 minutes, and the minimum time is 1 minute.

Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey pro-

test data

American Association of State Highway and Transportation Officials (AASHTO) (*1*), except as noted]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification	
Percentage smaller than 3 inches passing sieve—			Percentage smaller than—							
No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO [3]	Unified [4]
							Percent			
100	100	90	75	49	26	18	37	13	A–6(9)	ML–CL
100	100	98	88	57	36	29	43	21	A–7–6(13)	CL
100	100	96	83	50	24	15	35	12	A–6(9)	ML–CL
100	100	97	86	45	20	11	33	9	A–4(8)	ML–CL
100	99	94	79	38	18	14	36	8	A–4(8)	ML
100	100	97	85	43	23	18	36	13	A–6(9)	ML–CL
100	100	98	88	43	18	11	30	7	A–4(8)	ML–CL
100	99	90	78	44	23	17	34	12	A–6(9)	ML–CL
100	100	98	90	59	30	24	41	18	A–7–6(11)	CL
100	100	96	87	50	25	17	35	13	A–6(9)	ML–CL

and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for

mixes the soil horizons, and helps decompose plant material.

The soils of Norton County formed mainly under grass. The remains of grass roots and leaves add organic matter to the soils over a long period of time. As a result, the soils generally have a dark-colored surface layer.

Man also has had an effect on the soils. Poor cropping and tillage practices have removed the protective

many fossils of calcareous land snails. Many species of these snails are extinct or no longer found in the county. Fossils help geologists and soil scientists determine the age of the modern soil layers.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to

TABLE 10.—*Classification of soil series*

Series	Family	Subgroup	Order
Campus	Fine-loamy, mixed, mesic	Typic Calciustolls	Mollisols.
Canlon	Loamy, mixed (calcareous), mesic	Lithic Ustorthents	Entisols.
Coly	Fine-silty, mixed (calcareous), mesic	Typic Ustorthents	Entisols.
Cozad	Fine-silty, mixed, mesic	Typic Haplustolls	Mollisols.
Detroit	Fine, montmorillonitic, mesic	Pachic Argiustolls	Mollisols.
Hobbs	Fine-silty, mixed, mesic	Cumulic Haplustolls	Mollisols.

acres under cultivation. Wheat and grain sorghum are now the most important dryfarmed crops. According to the Kansas State Board of Agriculture, 87,000 acres of wheat, 39,000 acres of grain sorghum, 3,900 acres of corn, 2,000 acres of oats, 11,800 acres of alfalfa, and 8,000 acres of sorghum for forage were harvested in 1971.

Among the farm-related industries in the county are, in most towns, grain elevators where grain is bought and stored. Farm machinery is sold in Norton and Almena. Norton Lake and Prairie Dog State Park, about 4 miles west of Norton, provide facilities for camping, boating, fishing, swimming, and picnicking. There is also a game refuge in the area immediately

TABLE 12. Probabilities for specified low temperatures in spring and fall

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	April 11	April 15	April 18	May 5	May 14
2 years in 10 later than	April 5	April 9	April 13	April 30	May 9
5 years in 10 later than	March 24	March 30	April 4	April 20	April 29
Fall:					
1 year in 10 earlier than	October 29	October 21	October 17	October 7	September 27
2 years in 10 earlier than	November 4	October 26	October 21	October 12	October 1
5 years in 10 earlier than	November 16	November 6	October 31	October 21	October 11

Although the Gulf of Mexico is the principal source of moisture for precipitation in Kansas (*3*), the western part of the state, including Norton County, is infrequently in the flow of moist air from the Gulf. Norton County is in the rain shadow of the Rocky Mountains, and its annual rainfall is 22.7 inches. The low rainfall is partly offset by the seasonal distribution of precipitation. More then three-fourths of the precipitation is received during the 6-month period April through September. More than 2½ inches of rainfall is received each month during the period May through August, and an average of more than 4 inches is received in June, the wettest month. Winters are dry. On the average, less than 0.75 inch of rain is received in 1 month during the period December through February.

Snowfall in Norton County is light to moderate and averages about 24 inches a year. It has ranged from less than 12 inches in some winters to more than 0 in others. March is the month when snowfall is heaviest. Blizzards occur at times and bring high winds and drifting snow.

The annual average wind velocity is about 10 to 12 miles per hour. The highest average wind velocity, about 13 or 14 miles an hour, occurs in the period March through May. During periods of dry weather, particularly during March and April, strong winds may cause soil blowing. The prevailing winds are northerly and northwesterly during the period November through March and southerly during the period April through October.

southern part of the county and flows into the Solomon River to the southeast and then out of the county.

Elevation ranges from 2,012 feet above sea level in the North Fork Solomon River Valley in the southeastern part of the county to more than 2,550 feet near the western edge of the county.

Water Supply

Because Norton County receives a limited amount of rainfall, water is an important resource. For domestic use on farms, it is obtained mainly from wells that have been drilled or dug. For watering livestock

(11) _____ 1965. Land resource regions and major land resource areas of the United States. U.S. Dep. Agric. Handb. 296, 82 pp.
(12) United States Department of Defense. 1968. Unified soil classification system for roads, airfields, embankments and foundations. MIL–STD–619B, 30 pp., illus.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or

and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sud-

15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. Disintegrated and partly weathered rock from

zontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune

Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. An explanation of the capability classification system begins on page 21.

Map symbol	Mapping unit	Described on page	Capability unit Dryland	Capability unit Irrigated	Range site Name	Windbreak suitability group
Cc	Campus-Canlon complex, 6 to 30 percent slopes	9	VIe-3	-----	----------	--
	Campus	--	-----	-----	Limy Upland	--
	Canlon	--	-----	-----	Shallow Limy	--
Co	Coly and Uly silt loams, 6 to 10 percent slopes, eroded	10	IVe-1	-----	----------	3
	Coly	--	-----	-----	Limy Upland	--
	Uly	--	-----	-----	Loamy Upland	--
Cs	Coly and Uly silt loams, 10 to 20 percent slopes, eroded	10	VIe-1	-----	----------	3
	Coly	--	-----	-----	Limy Upland	--
	Uly	--	-----	-----	Loamy Upland	--
Cu	Cozad silt loam, 0 to 2 percent slopes	11	IIc-2	I-2	Loamy Terrace	1
Cz	Cozad silt loam, 2 to 5 percent slopes	11	IIe-2	IIe-2	Loamy Terrace	1
Dt	Detroit silty clay loam	12	IIc-3	I-3	Loamy Terrace	1
Hb	Hobbs silt loam	13	IIw-1	IIw-1	Loamy Lowland	1
Ho	Holdrege silt loam, 0 to 1 percent slopes	13	IIc-1	I-1	Loamy Upland	2
Hp	Holdrege silt loam, 1 to 3 percent slopes	14	IIe-1	IIe-1	Loamy Upland	2
Hr	Holdrege silt loam, 1 to 3 percent slopes, eroded	14	IIe-1	IIe-1	Loamy Upland	2
Hs	Holdrege silt loam, 3 to 6 percent slopes	14	IIIe-1	-----	Loamy Upland	2
Ht	Holdrege silt loam, 3 to 6 percent slopes, eroded	14	IIIe-1	-----	Loamy Upland	2
Hz	Hord silt loam	15	IIc-2	I-2	Loamy Terrace	1
Mu	Munjor complex	16	IIIw-1	IIw-2	Sandy Lowland	1
Rx	Roxbury silt loam	17	IIc-2	I-2	Loamy Terrace	1
Ub	Uly silt loam, 6 to 10 percent slopes	18	IVe-1	-----	Loamy Upland	3
Uc	Uly complex, 10 to 20 percent slopes	18	VIe-1	-----	Loamy Upland	3
Up	Uly-Penden complex, 6 to 20 percent slopes	19	VIe-1	-----	----------	3
	Uly	--	-----	-----	Loamy Upland	--
	Penden	--	-----	-----	Limy Upland	--

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